

Prediction Quality of African Ancestry

Aug 01, 2012

Table 1: The sensitivity (SEN), specificity (SPE), positive predictive value (PPV) and negative predictive value (NPV) calculated from validation samples for each four-digit HLA allele without call threshold, when Study Data of African ancestry were divided to training and validation parts with equal sizes. The SNP markers in the intersect of Illumina platforms were used.

| | Allele | Num. Train | Freq. Train | Num. Valid. | Freq. Valid. | CR ¹ (%) | ACC ¹ (%) | SEN (%) | SPE (%) | PPV (%) | NPV (%) | Miscall ² (%) |
|---------------------------------------|--------|---------------|----------------|----------------|-----------------|------------------------|-------------------------|------------|------------|------------|------------|-----------------------------|
| <i>HLA-A: Overall accuracy: 92.4%</i> | | | | | | | | | | | | |
| 1 | 01:01 | 5 | 0.0309 | 4 | 0.0339 | 100.0 | 99.2 | 75.0 | 100.0 | 100.0 | 99.1 | 36:01 (100) |
| 2 | 01:02 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 3 | 02:01 | 14 | 0.0864 | 10 | 0.0847 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 4 | 02:02 | 5 | 0.0309 | 2 | 0.0169 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 5 | 02:05 | 4 | 0.0247 | 2 | 0.0169 | 100.0 | 99.2 | 100.0 | 99.1 | 66.7 | 100.0 | - |
| 6 | 02:06 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 7 | 02:11 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 8 | 03:01 | 15 | 0.0926 | 9 | 0.0763 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 9 | 11:01 | 1 | 0.0062 | 1 | 0.0085 | 100.0 | 99.2 | 0.0 | 100.0 | - | 99.2 | 02:05 (100) |
| 10 | 23:01 | 11 | 0.0679 | 11 | 0.0932 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 11 | 24:02 | 3 | 0.0185 | 2 | 0.0169 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 12 | 24:07 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 13 | 24:17 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 14 | 24:24 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 15 | 26:01 | 4 | 0.0247 | 3 | 0.0254 | 100.0 | 99.2 | 100.0 | 99.1 | 75.0 | 100.0 | - |
| 16 | 29:01 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 17 | 29:02 | 3 | 0.0185 | 4 | 0.0339 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 18 | 30:01 | 14 | 0.0864 | 11 | 0.0932 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 19 | 30:02 | 8 | 0.0494 | 11 | 0.0932 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 20 | 30:04 | 2 | 0.0123 | 1 | 0.0085 | 100.0 | 99.2 | 0.0 | 100.0 | - | 99.2 | 26:01 (50) |
| 21 | 31:01 | 1 | 0.0062 | 1 | 0.0085 | 100.0 | 99.2 | 0.0 | 100.0 | - | 99.2 | 33:01 (100) |
| 22 | 32:01 | 2 | 0.0123 | 1 | 0.0085 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 23 | 33:01 | 3 | 0.0185 | 2 | 0.0169 | 100.0 | 99.2 | 100.0 | 99.1 | 66.7 | 100.0 | - |
| 24 | 33:03 | 13 | 0.0802 | 6 | 0.0508 | 100.0 | 99.2 | 100.0 | 99.1 | 85.7 | 100.0 | - |
| 25 | 34:02 | 6 | 0.0370 | 6 | 0.0508 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 26 | 36:01 | 9 | 0.0556 | 12 | 0.1017 | 100.0 | 98.3 | 91.7 | 99.1 | 91.7 | 99.1 | 33:03 (100) |
| 27 | 40:27 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |

Continued on next page ...

Table 1 – continued from previous page

| | Allele | Num. Train | Freq. Train | Num. Valid. | Freq. Valid. | CR ¹ (%) | ACC ¹ (%) | SEN (%) | SPE (%) | PPV (%) | NPV (%) | Miscall ² (%) |
|---------------------------------------|--------|---------------|----------------|----------------|-----------------|------------------------|-------------------------|------------|------------|------------|------------|-----------------------------|
| 28 | 43:01 | 1 | 0.0062 | – | – | – | – | – | – | – | – | – |
| 29 | 51:17 | 1 | 0.0062 | – | – | – | – | – | – | – | – | – |
| 30 | 66:01 | 1 | 0.0062 | – | – | – | – | – | – | – | – | – |
| 31 | 66:02 | 3 | 0.0185 | 1 | 0.0085 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 32 | 68:01 | 5 | 0.0309 | 4 | 0.0339 | 100.0 | 97.5 | 100.0 | 97.4 | 57.1 | 100.0 | – |
| 33 | 68:02 | 13 | 0.0802 | 10 | 0.0847 | 100.0 | 98.3 | 90.0 | 99.1 | 90.0 | 99.1 | 68:01 (100) |
| 34 | 68:27 | 1 | 0.0062 | – | – | – | – | – | – | – | – | – |
| 35 | 74:01 | 5 | 0.0309 | 4 | 0.0339 | 100.0 | 97.5 | 25.0 | 100.0 | 100.0 | 97.4 | 68:01 (67) |
| 36 | 80:01 | 1 | 0.0062 | – | – | – | – | – | – | – | – | – |
| <i>HLA-B: Overall accuracy: 76.8%</i> | | | | | | | | | | | | |
| 1 | 07:02 | 17 | 0.0850 | 10 | 0.0704 | 100.0 | 99.3 | 100.0 | 99.2 | 95.2 | 100.0 | – |
| 2 | 07:05 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 3 | 08:01 | 3 | 0.0150 | 2 | 0.0141 | 100.0 | 99.3 | 50.0 | 100.0 | 100.0 | 99.3 | 18:01 (50) |
| 4 | 13:01 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 5 | 13:02 | 2 | 0.0100 | 1 | 0.0070 | 100.0 | 99.3 | 0.0 | 100.0 | – | 99.3 | 15:10 (100) |
| 6 | 13:03 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 7 | 14:01 | 2 | 0.0100 | 4 | 0.0282 | 100.0 | 97.9 | 25.0 | 100.0 | 100.0 | 97.9 | 14:02 (33) |
| 8 | 14:02 | 2 | 0.0100 | 2 | 0.0141 | 100.0 | 99.3 | 100.0 | 99.3 | 66.7 | 100.0 | – |
| 9 | 14:03 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 10 | 15:01 | 2 | 0.0100 | 1 | 0.0070 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 11 | 15:03 | 9 | 0.0450 | 8 | 0.0563 | 100.0 | 99.3 | 87.5 | 100.0 | 100.0 | 99.3 | 18:01 (50) |
| 12 | 15:06 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 13 | 15:10 | 10 | 0.0500 | 9 | 0.0634 | 100.0 | 97.2 | 88.9 | 97.7 | 72.7 | 99.2 | 18:01 (100) |
| 14 | 15:13 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 15 | 15:16 | 4 | 0.0200 | 2 | 0.0141 | 100.0 | 98.6 | 100.0 | 98.6 | 50.0 | 100.0 | – |
| 16 | 15:17 | 2 | 0.0100 | – | – | – | – | – | – | – | – | – |
| 17 | 18:01 | 8 | 0.0400 | 4 | 0.0282 | 100.0 | 97.9 | 100.0 | 97.8 | 57.1 | 100.0 | – |
| 18 | 27:03 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 19 | 27:05 | 2 | 0.0100 | 3 | 0.0211 | 100.0 | 97.9 | 33.3 | 99.3 | 50.0 | 98.6 | 44:03 (100) |
| 20 | 35:01 | 14 | 0.0700 | 9 | 0.0634 | 100.0 | 97.2 | 66.7 | 99.2 | 85.7 | 97.8 | 53:01 (67) |
| 21 | 38:01 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 22 | 39:01 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 23 | 39:03 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 24 | 39:06 | 1 | 0.0050 | 1 | 0.0070 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 25 | 39:10 | 1 | 0.0050 | 1 | 0.0070 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 26 | 40:01 | 1 | 0.0050 | 1 | 0.0070 | 100.0 | 99.3 | 0.0 | 100.0 | – | 99.3 | 15:10 (100) |
| 27 | 40:02 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 28 | 41:01 | 2 | 0.0100 | 1 | 0.0070 | 100.0 | 99.3 | 0.0 | 100.0 | – | 99.3 | 42:01 (100) |
| 29 | 42:01 | 11 | 0.0550 | 6 | 0.0423 | 100.0 | 97.9 | 100.0 | 97.8 | 66.7 | 100.0 | – |
| 30 | 42:02 | 4 | 0.0200 | 2 | 0.0141 | 100.0 | 98.6 | 0.0 | 100.0 | – | 98.6 | 42:01 (100) |
| 31 | 44:03 | 10 | 0.0500 | 6 | 0.0423 | 100.0 | 97.9 | 83.3 | 98.5 | 71.4 | 99.3 | 35:01 (100) |
| 32 | 45:01 | 6 | 0.0300 | 3 | 0.0211 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 33 | 49:01 | 6 | 0.0300 | 5 | 0.0352 | 100.0 | 99.3 | 80.0 | 100.0 | 100.0 | 99.3 | 07:02 (50) |
| 34 | 50:02 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 35 | 51:01 | 7 | 0.0350 | 6 | 0.0423 | 100.0 | 95.8 | 50.0 | 97.8 | 50.0 | 97.8 | 52:01 (67) |
| 36 | 52:01 | 8 | 0.0400 | 9 | 0.0634 | 100.0 | 96.5 | 66.7 | 98.5 | 75.0 | 97.8 | 51:01 (67) |

Continued on next page ...

Table 1 – continued from previous page

| | Allele | Num. Train | Freq. Train | Num. Valid. | Freq. Valid. | CR ¹ (%) | ACC ¹ (%) | SEN (%) | SPE (%) | PPV (%) | NPV (%) | Miscall ² (%) |
|--|--------|---------------|----------------|----------------|-----------------|------------------------|-------------------------|------------|------------|------------|------------|-----------------------------|
| 37 | 53:01 | 24 | 0.1200 | 21 | 0.1479 | 100.0 | 94.4 | 81.0 | 96.7 | 79.1 | 96.7 | 58:02 (75) |
| 38 | 56:01 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 39 | 57:01 | 2 | 0.0100 | 2 | 0.0141 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 40 | 57:02 | 2 | 0.0100 | 1 | 0.0070 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 41 | 57:03 | 8 | 0.0400 | 6 | 0.0423 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 42 | 58:01 | 7 | 0.0350 | 9 | 0.0634 | 100.0 | 97.2 | 66.7 | 99.2 | 85.7 | 97.8 | 53:01 (67) |
| 43 | 58:02 | 8 | 0.0400 | 5 | 0.0352 | 100.0 | 97.2 | 100.0 | 97.1 | 55.6 | 100.0 | – |
| 44 | 78:01 | 1 | 0.0050 | 1 | 0.0070 | 100.0 | 99.3 | 0.0 | 100.0 | – | 99.3 | 51:01 (100) |
| 45 | 81:01 | 1 | 0.0050 | 1 | 0.0070 | 100.0 | 99.3 | 0.0 | 100.0 | – | 99.3 | – |
| <i>HLA-C: Overall accuracy: 88.5%</i> | | | | | | | | | | | | |
| 1 | 01:02 | 1 | 0.0068 | 1 | 0.0077 | 100.0 | 99.2 | 0.0 | 100.0 | – | 99.2 | 07:01 (100) |
| 2 | 02:02 | 9 | 0.0608 | 9 | 0.0692 | 100.0 | 96.9 | 77.8 | 98.3 | 77.8 | 98.3 | 02:10 (100) |
| 3 | 02:10 | 5 | 0.0338 | 5 | 0.0385 | 100.0 | 96.2 | 40.0 | 98.4 | 50.0 | 97.6 | 02:02 (67) |
| 4 | 03:02 | 4 | 0.0270 | 5 | 0.0385 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 5 | 03:03 | 1 | 0.0068 | 1 | 0.0077 | 100.0 | 99.2 | 0.0 | 100.0 | – | 99.2 | 14:02 (100) |
| 6 | 03:04 | 3 | 0.0203 | 3 | 0.0231 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 7 | 04:01 | 28 | 0.1892 | 25 | 0.1923 | 100.0 | 98.5 | 96.0 | 99.0 | 96.0 | 99.0 | 07:01 (100) |
| 8 | 04:03 | 1 | 0.0068 | 1 | 0.0077 | 100.0 | 99.2 | 0.0 | 100.0 | – | 99.2 | 07:02 (100) |
| 9 | 05:01 | 1 | 0.0068 | 1 | 0.0077 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 10 | 06:02 | 6 | 0.0405 | 11 | 0.0846 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 11 | 07:01 | 24 | 0.1622 | 9 | 0.0692 | 100.0 | 98.5 | 100.0 | 98.3 | 81.8 | 100.0 | – |
| 12 | 07:02 | 13 | 0.0878 | 8 | 0.0615 | 100.0 | 98.5 | 100.0 | 98.4 | 80.0 | 100.0 | – |
| 13 | 07:04 | 1 | 0.0068 | 1 | 0.0077 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 14 | 08:01 | 1 | 0.0068 | 1 | 0.0077 | 100.0 | 99.2 | 0.0 | 100.0 | – | 99.2 | 08:04 (100) |
| 15 | 08:02 | 4 | 0.0270 | 4 | 0.0308 | 100.0 | 96.9 | 0.0 | 100.0 | – | 96.9 | 08:04 (100) |
| 16 | 08:04 | 8 | 0.0541 | 4 | 0.0308 | 100.0 | 96.2 | 100.0 | 96.0 | 44.4 | 100.0 | – |
| 17 | 12:02 | 1 | 0.0068 | – | – | – | – | – | – | – | – | – |
| 18 | 12:03 | 1 | 0.0068 | 2 | 0.0154 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 19 | 14:02 | 3 | 0.0203 | 3 | 0.0231 | 100.0 | 99.2 | 100.0 | 99.2 | 75.0 | 100.0 | – |
| 20 | 15:05 | 1 | 0.0068 | 1 | 0.0077 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 21 | 16:01 | 15 | 0.1014 | 20 | 0.1538 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 22 | 16:02 | 1 | 0.0068 | – | – | – | – | – | – | – | – | – |
| 23 | 17:01 | 11 | 0.0743 | 12 | 0.0923 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 24 | 18:01 | 5 | 0.0338 | 3 | 0.0231 | 100.0 | 99.2 | 66.7 | 100.0 | 100.0 | 99.2 | 04:01 (100) |
| <i>HLA-DRB1: Overall accuracy: 77.1%</i> | | | | | | | | | | | | |
| 1 | 01:01 | 4 | 0.0225 | 3 | 0.0208 | 100.0 | 99.3 | 66.7 | 100.0 | 100.0 | 99.3 | 01:02 (100) |
| 2 | 01:02 | 5 | 0.0281 | 3 | 0.0208 | 100.0 | 99.3 | 100.0 | 99.3 | 75.0 | 100.0 | – |
| 3 | 03:01 | 11 | 0.0618 | 9 | 0.0625 | 100.0 | 96.5 | 55.6 | 99.3 | 83.3 | 97.1 | 11:01 (50) |
| 4 | 03:02 | 9 | 0.0506 | 11 | 0.0764 | 100.0 | 98.6 | 81.8 | 100.0 | 100.0 | 98.5 | 13:01 (50) |
| 5 | 04:01 | 4 | 0.0225 | 3 | 0.0208 | 100.0 | 97.9 | 66.7 | 98.6 | 57.1 | 99.3 | 04:03 (100) |
| 6 | 04:03 | 1 | 0.0056 | 1 | 0.0069 | 100.0 | 98.6 | 0.0 | 99.3 | 0.0 | 99.3 | 04:01 (100) |
| 7 | 04:04 | 1 | 0.0056 | 3 | 0.0208 | 100.0 | 97.9 | 0.0 | 100.0 | – | 97.9 | 07:01 (100) |
| 8 | 04:05 | 1 | 0.0056 | 1 | 0.0069 | 100.0 | 99.3 | 0.0 | 100.0 | – | 99.3 | 04:01 (50) |
| 9 | 04:07 | 1 | 0.0056 | – | – | – | – | – | – | – | – | – |
| 10 | 07:01 | 19 | 0.1067 | 13 | 0.0903 | 100.0 | 95.8 | 100.0 | 95.4 | 66.7 | 100.0 | – |
| 11 | 08:04 | 11 | 0.0618 | 11 | 0.0764 | 100.0 | 97.2 | 72.7 | 99.2 | 88.9 | 97.8 | 13:02 (100) |

Continued on next page ...

Table 1 – continued from previous page

| | Allele | Num. Train | Freq. Train | Num. Valid. | Freq. Valid. | CR ¹ (%) | ACC ¹ (%) | SEN (%) | SPE (%) | PPV (%) | NPV (%) | Miscall ² (%) |
|--|--------|---------------|----------------|----------------|-----------------|------------------------|-------------------------|------------|------------|------------|------------|-----------------------------|
| 12 | 08:06 | 1 | 0.0056 | 1 | 0.0069 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 13 | 09:01 | 6 | 0.0337 | 6 | 0.0417 | 100.0 | 98.6 | 66.7 | 100.0 | 100.0 | 98.6 | 07:01 (100) |
| 14 | 10:01 | 5 | 0.0281 | 2 | 0.0139 | 100.0 | 99.3 | 100.0 | 99.3 | 66.7 | 100.0 | – |
| 15 | 11:01 | 13 | 0.0730 | 12 | 0.0833 | 100.0 | 95.1 | 91.7 | 95.5 | 64.7 | 99.2 | 10:01 (100) |
| 16 | 11:02 | 6 | 0.0337 | 5 | 0.0347 | 100.0 | 98.6 | 80.0 | 99.3 | 80.0 | 99.3 | 03:01 (100) |
| 17 | 11:03 | 1 | 0.0056 | – | – | – | – | – | – | – | – | – |
| 18 | 11:04 | 3 | 0.0169 | 2 | 0.0139 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 19 | 12:01 | 8 | 0.0449 | 3 | 0.0208 | 100.0 | 98.6 | 100.0 | 98.6 | 50.0 | 100.0 | – |
| 20 | 12:02 | 3 | 0.0169 | 2 | 0.0139 | 100.0 | 99.3 | 50.0 | 100.0 | 100.0 | 99.3 | 11:01 (100) |
| 21 | 13:01 | 13 | 0.0730 | 13 | 0.0903 | 100.0 | 95.1 | 76.9 | 96.9 | 76.9 | 97.7 | 11:01 (33) |
| 22 | 13:02 | 10 | 0.0562 | 8 | 0.0556 | 100.0 | 96.5 | 75.0 | 97.8 | 66.7 | 98.5 | 11:01 (50) |
| 23 | 13:03 | 11 | 0.0618 | 8 | 0.0556 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 24 | 13:27 | 1 | 0.0056 | – | – | – | – | – | – | – | – | – |
| 25 | 13:35 | 1 | 0.0056 | – | – | – | – | – | – | – | – | – |
| 26 | 14:01 | 3 | 0.0169 | 2 | 0.0139 | 100.0 | 98.6 | 0.0 | 100.0 | – | 98.6 | 15:03 (50) |
| 27 | 14:04 | 1 | 0.0056 | 1 | 0.0069 | 100.0 | 99.3 | 0.0 | 100.0 | – | 99.3 | 07:01 (50) |
| 28 | 15:01 | 5 | 0.0281 | 5 | 0.0347 | 100.0 | 98.6 | 60.0 | 100.0 | 100.0 | 98.6 | 15:03 (100) |
| 29 | 15:03 | 17 | 0.0955 | 13 | 0.0903 | 100.0 | 96.5 | 92.3 | 96.9 | 75.0 | 99.2 | 11:01 (100) |
| 30 | 16:02 | 3 | 0.0169 | 3 | 0.0208 | 100.0 | 99.3 | 66.7 | 100.0 | 100.0 | 99.3 | 11:02 (100) |
| <i>HLA-DQA1: Overall accuracy: 80.0%</i> | | | | | | | | | | | | |
| 1 | 01:01 | 10 | 0.0725 | 9 | 0.0692 | 100.0 | 95.4 | 66.7 | 97.5 | 66.7 | 97.5 | 01:02 (67) |
| 2 | 01:02 | 41 | 0.2971 | 31 | 0.2385 | 100.0 | 93.8 | 90.3 | 94.9 | 84.8 | 96.9 | 01:01 (67) |
| 3 | 01:03 | 10 | 0.0725 | 10 | 0.0769 | 100.0 | 97.7 | 90.0 | 98.3 | 85.7 | 99.2 | 01:02 (100) |
| 4 | 01:04 | 1 | 0.0072 | 1 | 0.0077 | 100.0 | 99.2 | 0.0 | 100.0 | – | 99.2 | 01:02 (100) |
| 5 | 01:05 | 5 | 0.0362 | 4 | 0.0308 | 100.0 | 97.7 | 50.0 | 99.2 | 66.7 | 98.4 | 01:01 (50) |
| 6 | 02:01 | 16 | 0.1159 | 16 | 0.1231 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 7 | 03:01 | 6 | 0.0435 | 5 | 0.0385 | 100.0 | 96.9 | 100.0 | 96.8 | 52.6 | 100.0 | – |
| 8 | 03:02 | 1 | 0.0072 | – | – | – | – | – | – | – | – | – |
| 9 | 03:03 | 8 | 0.0580 | 9 | 0.0692 | 100.0 | 95.4 | 44.4 | 99.2 | 80.0 | 96.0 | 03:01 (80) |
| 10 | 04:01 | 15 | 0.1087 | 15 | 0.1154 | 100.0 | 97.7 | 100.0 | 97.4 | 83.3 | 100.0 | – |
| 11 | 05:01 | 14 | 0.1014 | 19 | 0.1462 | 100.0 | 92.3 | 78.9 | 94.6 | 71.4 | 96.3 | 04:01 (50) |
| 12 | 05:05 | 9 | 0.0652 | 9 | 0.0692 | 100.0 | 94.6 | 33.3 | 99.2 | 75.0 | 95.2 | 05:01 (100) |
| 13 | 06:01 | 2 | 0.0145 | 2 | 0.0154 | 100.0 | 99.2 | 50.0 | 100.0 | 100.0 | 99.2 | 04:01 (100) |
| <i>HLA-DQB1 Overall accuracy: 79.4%</i> | | | | | | | | | | | | |
| 1 | 02:01 | 17 | 0.1149 | 16 | 0.1270 | 100.0 | 92.9 | 68.8 | 96.4 | 75.9 | 95.5 | 02:02 (60) |
| 2 | 02:02 | 12 | 0.0811 | 14 | 0.1111 | 100.0 | 92.1 | 50.0 | 97.3 | 70.0 | 94.0 | 02:01 (50) |
| 3 | 02:03 | 1 | 0.0068 | – | – | – | – | – | – | – | – | – |
| 4 | 03:01 | 20 | 0.1351 | 16 | 0.1270 | 100.0 | 92.9 | 93.8 | 92.7 | 63.8 | 99.0 | 06:02 (50) |
| 5 | 03:02 | 7 | 0.0473 | 6 | 0.0476 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 6 | 03:03 | 2 | 0.0135 | 1 | 0.0079 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 7 | 03:09 | 1 | 0.0068 | – | – | – | – | – | – | – | – | – |
| 8 | 03:19 | 9 | 0.0608 | 7 | 0.0556 | 100.0 | 96.8 | 42.9 | 100.0 | 100.0 | 96.7 | 03:01 (100) |
| 9 | 04:02 | 11 | 0.0743 | 10 | 0.0794 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 10 | 05:01 | 18 | 0.1216 | 19 | 0.1508 | 100.0 | 99.2 | 100.0 | 99.1 | 95.0 | 100.0 | – |
| 11 | 05:02 | 6 | 0.0405 | 5 | 0.0397 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 12 | 05:03 | 2 | 0.0135 | 2 | 0.0159 | 100.0 | 98.4 | 0.0 | 100.0 | – | 98.4 | 06:02 (100) |

Continued on next page ...

Table 1 – continued from previous page

| | Allele | Num. Train | Freq. Train | Num. Valid. | Freq. Valid. | CR ¹ (%) | ACC ¹ (%) | SEN (%) | SPE (%) | PPV (%) | NPV (%) | Miscall ² (%) |
|--|--------|---------------|----------------|----------------|-----------------|------------------------|-------------------------|------------|------------|------------|------------|-----------------------------|
| 13 | 06:02 | 26 | 0.1757 | 18 | 0.1429 | 100.0 | 92.9 | 88.9 | 93.5 | 69.6 | 98.1 | 05:01 (50) |
| 14 | 06:03 | 7 | 0.0473 | 6 | 0.0476 | 100.0 | 98.4 | 83.3 | 99.2 | 83.3 | 99.2 | 06:02 (100) |
| 15 | 06:04 | 3 | 0.0203 | 2 | 0.0159 | 100.0 | 99.2 | 50.0 | 100.0 | 100.0 | 99.2 | 06:02 (100) |
| 16 | 06:05 | 2 | 0.0135 | 2 | 0.0159 | 100.0 | 98.4 | 0.0 | 100.0 | – | 98.4 | 06:09 (50) |
| 17 | 06:09 | 4 | 0.0270 | 2 | 0.0159 | 100.0 | 98.4 | 50.0 | 99.2 | 50.0 | 99.2 | 06:02 (100) |
| <i>HLA-DPB1: Overall accuracy: 74.2%</i> | | | | | | | | | | | | |
| 1 | 01:01 | 17 | 0.1932 | 16 | 0.2581 | 100.0 | 88.7 | 100.0 | 84.8 | 69.6 | 100.0 | – |
| 2 | 02:01 | 15 | 0.1705 | 9 | 0.1452 | 100.0 | 91.9 | 100.0 | 90.6 | 64.3 | 100.0 | – |
| 3 | 03:01 | 2 | 0.0227 | 1 | 0.0161 | 100.0 | 98.4 | 0.0 | 100.0 | – | 98.4 | 01:01 (100) |
| 4 | 04:01 | 8 | 0.0909 | 6 | 0.0968 | 100.0 | 96.8 | 83.3 | 98.2 | 83.3 | 98.2 | 02:01 (100) |
| 5 | 04:02 | 1 | 0.0114 | 1 | 0.0161 | 100.0 | 98.4 | 0.0 | 100.0 | – | 98.4 | 06:02 (100) |
| 6 | 05:01 | 1 | 0.0114 | 1 | 0.0161 | 100.0 | 98.4 | 0.0 | 100.0 | – | 98.4 | 01:01 (50) |
| 7 | 06:02 | 14 | 0.1591 | 12 | 0.1935 | 100.0 | 93.5 | 83.3 | 96.0 | 83.3 | 96.0 | 04:01 (50) |
| 8 | 09:01 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 9 | 09:02 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 10 | 10:01 | 1 | 0.0114 | 1 | 0.0161 | 100.0 | 98.4 | 0.0 | 100.0 | – | 98.4 | 01:01 (100) |
| 11 | 11:01 | 3 | 0.0341 | 3 | 0.0484 | 100.0 | 95.2 | 0.0 | 100.0 | – | 95.2 | 01:01 (67) |
| 12 | 13:01 | 2 | 0.0227 | 1 | 0.0161 | 100.0 | 98.4 | 0.0 | 100.0 | – | 98.4 | 06:02 (100) |
| 13 | 15:01 | 1 | 0.0114 | 1 | 0.0161 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 14 | 17:01 | 7 | 0.0795 | 3 | 0.0484 | 100.0 | 95.2 | 33.3 | 98.3 | 50.0 | 96.7 | 01:01 (100) |
| 15 | 18:01 | 3 | 0.0341 | 3 | 0.0484 | 100.0 | 98.4 | 66.7 | 100.0 | 100.0 | 98.3 | 02:01 (100) |
| 16 | 20:01 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 17 | 34:01 | 2 | 0.0227 | 1 | 0.0161 | 100.0 | 98.4 | 0.0 | 100.0 | – | 98.4 | 17:01 (100) |
| 18 | 49:01 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 19 | 55:01 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 20 | 71:01 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 21 | 80:01 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 22 | 85:01 | 1 | 0.0114 | 1 | 0.0161 | 100.0 | 98.4 | 0.0 | 100.0 | – | 98.4 | 02:01 (100) |
| 23 | 104:01 | 3 | 0.0341 | 2 | 0.0323 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |

¹: CR – call rate; ACC – allele accuracy.²: the most likely miscalled allele and the proportion of the most likely miscalled allele in all miscalled alleles.

Table 2: The sensitivity (SEN), specificity (SPE), positive predictive value (PPV) and negative predictive value (NPV) calculated from validation samples for each four-digit HLA allele with call threshold 0.5, when Study Data of African ancestry were divided to training and validation parts with equal sizes. The SNP markers in the intersect of Illumina platforms were used.

| | Allele | Num. Train | Freq. Train | Num. Valid. | Freq. Valid. | CR ¹ (%) | ACC ¹ (%) | SEN (%) | SPE (%) | PPV (%) | NPV (%) | Miscall ² (%) |
|---|--------|---------------|----------------|----------------|-----------------|------------------------|-------------------------|------------|------------|------------|------------|-----------------------------|
| <i>HLA-A: Overall accuracy: 100%, Call rate: 74.6%</i> | | | | | | | | | | | | |
| 1 | 01:01 | 5 | 0.0309 | 4 | 0.0339 | 75.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 2 | 01:02 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 3 | 02:01 | 14 | 0.0864 | 10 | 0.0847 | 80.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 4 | 02:02 | 5 | 0.0309 | 2 | 0.0169 | 0.0 | - | - | - | - | - | - |
| 5 | 02:05 | 4 | 0.0247 | 2 | 0.0169 | 50.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 6 | 02:06 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 7 | 02:11 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 8 | 03:01 | 15 | 0.0926 | 9 | 0.0763 | 88.9 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 9 | 11:01 | 1 | 0.0062 | 1 | 0.0085 | 0.0 | - | - | - | - | - | - |
| 10 | 23:01 | 11 | 0.0679 | 11 | 0.0932 | 90.9 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 11 | 24:02 | 3 | 0.0185 | 2 | 0.0169 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 12 | 24:07 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 13 | 24:17 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 14 | 24:24 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 15 | 26:01 | 4 | 0.0247 | 3 | 0.0254 | 66.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 16 | 29:01 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 17 | 29:02 | 3 | 0.0185 | 4 | 0.0339 | 25.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 18 | 30:01 | 14 | 0.0864 | 11 | 0.0932 | 90.9 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 19 | 30:02 | 8 | 0.0494 | 11 | 0.0932 | 72.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 20 | 30:04 | 2 | 0.0123 | 1 | 0.0085 | 0.0 | - | - | - | - | - | - |
| 21 | 31:01 | 1 | 0.0062 | 1 | 0.0085 | 0.0 | - | - | - | - | - | - |
| 22 | 32:01 | 2 | 0.0123 | 1 | 0.0085 | 0.0 | - | - | - | - | - | - |
| 23 | 33:01 | 3 | 0.0185 | 2 | 0.0169 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 24 | 33:03 | 13 | 0.0802 | 6 | 0.0508 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 25 | 34:02 | 6 | 0.0370 | 6 | 0.0508 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 26 | 36:01 | 9 | 0.0556 | 12 | 0.1017 | 91.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 27 | 40:27 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 28 | 43:01 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 29 | 51:17 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 30 | 66:01 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 31 | 66:02 | 3 | 0.0185 | 1 | 0.0085 | 0.0 | - | - | - | - | - | - |
| 32 | 68:01 | 5 | 0.0309 | 4 | 0.0339 | 75.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 33 | 68:02 | 13 | 0.0802 | 10 | 0.0847 | 70.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 34 | 68:27 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| 35 | 74:01 | 5 | 0.0309 | 4 | 0.0339 | 0.0 | - | - | - | - | - | - |
| 36 | 80:01 | 1 | 0.0062 | - | - | - | - | - | - | - | - | - |
| <i>HLA-B: Overall accuracy: 96.7%, Call rate: 21.1%</i> | | | | | | | | | | | | |
| 1 | 07:02 | 17 | 0.0850 | 10 | 0.0704 | 30.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 2 | 07:05 | 1 | 0.0050 | - | - | - | - | - | - | - | - | - |
| 3 | 08:01 | 3 | 0.0150 | 2 | 0.0141 | 0.0 | - | - | - | - | - | - |

Continued on next page ...

Table 2 – continued from previous page

| | Allele | Num. Train | Freq. Train | Num. Valid. | Freq. Valid. | CR ¹ (%) | ACC ¹ (%) | SEN (%) | SPE (%) | PPV (%) | NPV (%) | Miscall ² (%) |
|---|--------|---------------|----------------|----------------|-----------------|------------------------|-------------------------|------------|------------|------------|------------|-----------------------------|
| 4 | 13:01 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 5 | 13:02 | 2 | 0.0100 | 1 | 0.0070 | 0.0 | – | – | – | – | – | – |
| 6 | 13:03 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 7 | 14:01 | 2 | 0.0100 | 4 | 0.0282 | 0.0 | – | – | – | – | – | – |
| 8 | 14:02 | 2 | 0.0100 | 2 | 0.0141 | 50.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 9 | 14:03 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 10 | 15:01 | 2 | 0.0100 | 1 | 0.0070 | 0.0 | – | – | – | – | – | – |
| 11 | 15:03 | 9 | 0.0450 | 8 | 0.0563 | 25.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 12 | 15:06 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 13 | 15:10 | 10 | 0.0500 | 9 | 0.0634 | 0.0 | – | – | – | – | – | – |
| 14 | 15:13 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 15 | 15:16 | 4 | 0.0200 | 2 | 0.0141 | 0.0 | – | – | – | – | – | – |
| 16 | 15:17 | 2 | 0.0100 | – | – | – | – | – | – | – | – | – |
| 17 | 18:01 | 8 | 0.0400 | 4 | 0.0282 | 25.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 18 | 27:03 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 19 | 27:05 | 2 | 0.0100 | 3 | 0.0211 | 0.0 | – | – | – | – | – | – |
| 20 | 35:01 | 14 | 0.0700 | 9 | 0.0634 | 22.2 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 21 | 38:01 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 22 | 39:01 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 23 | 39:03 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 24 | 39:06 | 1 | 0.0050 | 1 | 0.0070 | 0.0 | – | – | – | – | – | – |
| 25 | 39:10 | 1 | 0.0050 | 1 | 0.0070 | 0.0 | – | – | – | – | – | – |
| 26 | 40:01 | 1 | 0.0050 | 1 | 0.0070 | 0.0 | – | – | – | – | – | – |
| 27 | 40:02 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 28 | 41:01 | 2 | 0.0100 | 1 | 0.0070 | 0.0 | – | – | – | – | – | – |
| 29 | 42:01 | 11 | 0.0550 | 6 | 0.0423 | 50.0 | 96.7 | 100.0 | 96.3 | 75.0 | 100.0 | – |
| 30 | 42:02 | 4 | 0.0200 | 2 | 0.0141 | 50.0 | 96.7 | 0.0 | 100.0 | – | 99.3 | 42:01 (100) |
| 31 | 44:03 | 10 | 0.0500 | 6 | 0.0423 | 0.0 | – | – | – | – | – | – |
| 32 | 45:01 | 6 | 0.0300 | 3 | 0.0211 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 33 | 49:01 | 6 | 0.0300 | 5 | 0.0352 | 20.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 34 | 50:02 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 35 | 51:01 | 7 | 0.0350 | 6 | 0.0423 | 0.0 | – | – | – | – | – | – |
| 36 | 52:01 | 8 | 0.0400 | 9 | 0.0634 | 0.0 | – | – | – | – | – | – |
| 37 | 53:01 | 24 | 0.1200 | 21 | 0.1479 | 47.6 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 38 | 56:01 | 1 | 0.0050 | – | – | – | – | – | – | – | – | – |
| 39 | 57:01 | 2 | 0.0100 | 2 | 0.0141 | 0.0 | – | – | – | – | – | – |
| 40 | 57:02 | 2 | 0.0100 | 1 | 0.0070 | 0.0 | – | – | – | – | – | – |
| 41 | 57:03 | 8 | 0.0400 | 6 | 0.0423 | 16.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 42 | 58:01 | 7 | 0.0350 | 9 | 0.0634 | 0.0 | – | – | – | – | – | – |
| 43 | 58:02 | 8 | 0.0400 | 5 | 0.0352 | 40.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 44 | 78:01 | 1 | 0.0050 | 1 | 0.0070 | 0.0 | – | – | – | – | – | – |
| 45 | 81:01 | 1 | 0.0050 | 1 | 0.0070 | 0.0 | – | – | – | – | – | – |
| <i>HLA-C: Overall accuracy: 96.5%, Call rate: 66.2%</i> | | | | | | | | | | | | |
| 1 | 01:02 | 1 | 0.0068 | 1 | 0.0077 | 0.0 | – | – | – | – | – | – |
| 2 | 02:02 | 9 | 0.0608 | 9 | 0.0692 | 44.4 | 97.7 | 50.0 | 100.0 | 100.0 | 98.4 | 02:10 (100) |
| 3 | 02:10 | 5 | 0.0338 | 5 | 0.0385 | 20.0 | 97.7 | 100.0 | 97.6 | 33.3 | 100.0 | – |

Continued on next page ...

Table 2 – continued from previous page

| | Allele | Num. Train | Freq. Train | Num. Valid. | Freq. Valid. | CR ¹ (%) | ACC ¹ (%) | SEN (%) | SPE (%) | PPV (%) | NPV (%) | Miscall ² (%) |
|---|--------|---------------|----------------|----------------|-----------------|------------------------|-------------------------|------------|------------|------------|------------|-----------------------------|
| 4 | 03:02 | 4 | 0.0270 | 5 | 0.0385 | 80.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 5 | 03:03 | 1 | 0.0068 | 1 | 0.0077 | 0.0 | – | – | – | – | – | – |
| 6 | 03:04 | 3 | 0.0203 | 3 | 0.0231 | 0.0 | – | – | – | – | – | – |
| 7 | 04:01 | 28 | 0.1892 | 25 | 0.1923 | 80.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 8 | 04:03 | 1 | 0.0068 | 1 | 0.0077 | 0.0 | – | – | – | – | – | – |
| 9 | 05:01 | 1 | 0.0068 | 1 | 0.0077 | 0.0 | – | – | – | – | – | – |
| 10 | 06:02 | 6 | 0.0405 | 11 | 0.0846 | 63.6 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 11 | 07:01 | 24 | 0.1622 | 9 | 0.0692 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 12 | 07:02 | 13 | 0.0878 | 8 | 0.0615 | 62.5 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 13 | 07:04 | 1 | 0.0068 | 1 | 0.0077 | 0.0 | – | – | – | – | – | – |
| 14 | 08:01 | 1 | 0.0068 | 1 | 0.0077 | 0.0 | – | – | – | – | – | – |
| 15 | 08:02 | 4 | 0.0270 | 4 | 0.0308 | 25.0 | 98.8 | 0.0 | 100.0 | – | 99.2 | 08:04 (100) |
| 16 | 08:04 | 8 | 0.0541 | 4 | 0.0308 | 50.0 | 98.8 | 100.0 | 98.8 | 66.7 | 100.0 | – |
| 17 | 12:02 | 1 | 0.0068 | – | – | – | – | – | – | – | – | – |
| 18 | 12:03 | 1 | 0.0068 | 2 | 0.0154 | 0.0 | – | – | – | – | – | – |
| 19 | 14:02 | 3 | 0.0203 | 3 | 0.0231 | 66.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 20 | 15:05 | 1 | 0.0068 | 1 | 0.0077 | 0.0 | – | – | – | – | – | – |
| 21 | 16:01 | 15 | 0.1014 | 20 | 0.1538 | 90.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 22 | 16:02 | 1 | 0.0068 | – | – | – | – | – | – | – | – | – |
| 23 | 17:01 | 11 | 0.0743 | 12 | 0.0923 | 91.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 24 | 18:01 | 5 | 0.0338 | 3 | 0.0231 | 66.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| <i>HLA-DRB1: Overall accuracy: 100%, Call rate: 22.2%</i> | | | | | | | | | | | | |
| 1 | 01:01 | 4 | 0.0225 | 3 | 0.0208 | 0.0 | – | – | – | – | – | – |
| 2 | 01:02 | 5 | 0.0281 | 3 | 0.0208 | 33.3 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 3 | 03:01 | 11 | 0.0618 | 9 | 0.0625 | 22.2 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 4 | 03:02 | 9 | 0.0506 | 11 | 0.0764 | 27.3 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 5 | 04:01 | 4 | 0.0225 | 3 | 0.0208 | 0.0 | – | – | – | – | – | – |
| 6 | 04:03 | 1 | 0.0056 | 1 | 0.0069 | 0.0 | – | – | – | – | – | – |
| 7 | 04:04 | 1 | 0.0056 | 3 | 0.0208 | 0.0 | – | – | – | – | – | – |
| 8 | 04:05 | 1 | 0.0056 | 1 | 0.0069 | 0.0 | – | – | – | – | – | – |
| 9 | 04:07 | 1 | 0.0056 | – | – | – | – | – | – | – | – | – |
| 10 | 07:01 | 19 | 0.1067 | 13 | 0.0903 | 30.8 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 11 | 08:04 | 11 | 0.0618 | 11 | 0.0764 | 36.4 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 12 | 08:06 | 1 | 0.0056 | 1 | 0.0069 | 0.0 | – | – | – | – | – | – |
| 13 | 09:01 | 6 | 0.0337 | 6 | 0.0417 | 33.3 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 14 | 10:01 | 5 | 0.0281 | 2 | 0.0139 | 0.0 | – | – | – | – | – | – |
| 15 | 11:01 | 13 | 0.0730 | 12 | 0.0833 | 33.3 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 16 | 11:02 | 6 | 0.0337 | 5 | 0.0347 | 40.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 17 | 11:03 | 1 | 0.0056 | – | – | – | – | – | – | – | – | – |
| 18 | 11:04 | 3 | 0.0169 | 2 | 0.0139 | 0.0 | – | – | – | – | – | – |
| 19 | 12:01 | 8 | 0.0449 | 3 | 0.0208 | 0.0 | – | – | – | – | – | – |
| 20 | 12:02 | 3 | 0.0169 | 2 | 0.0139 | 0.0 | – | – | – | – | – | – |
| 21 | 13:01 | 13 | 0.0730 | 13 | 0.0903 | 15.4 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 22 | 13:02 | 10 | 0.0562 | 8 | 0.0556 | 12.5 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 23 | 13:03 | 11 | 0.0618 | 8 | 0.0556 | 25.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 24 | 13:27 | 1 | 0.0056 | – | – | – | – | – | – | – | – | – |

Continued on next page ...

Table 2 – continued from previous page

| | Allele | Num. Train | Freq. Train | Num. Valid. | Freq. Valid. | CR ¹ (%) | ACC ¹ (%) | SEN (%) | SPE (%) | PPV (%) | NPV (%) | Miscall ² (%) |
|--|--------|---------------|----------------|----------------|-----------------|------------------------|-------------------------|------------|------------|------------|------------|-----------------------------|
| 25 | 13:35 | 1 | 0.0056 | – | – | – | – | – | – | – | – | – |
| 26 | 14:01 | 3 | 0.0169 | 2 | 0.0139 | 0.0 | – | – | – | – | – | – |
| 27 | 14:04 | 1 | 0.0056 | 1 | 0.0069 | 0.0 | – | – | – | – | – | – |
| 28 | 15:01 | 5 | 0.0281 | 5 | 0.0347 | 0.0 | – | – | – | – | – | – |
| 29 | 15:03 | 17 | 0.0955 | 13 | 0.0903 | 30.8 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 30 | 16:02 | 3 | 0.0169 | 3 | 0.0208 | 33.3 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| <i>HLA-DQA1: Overall accuracy: 97.2%, Call rate: 27.7%</i> | | | | | | | | | | | | |
| 1 | 01:01 | 10 | 0.0725 | 9 | 0.0692 | 11.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 2 | 01:02 | 41 | 0.2971 | 31 | 0.2385 | 35.5 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 3 | 01:03 | 10 | 0.0725 | 10 | 0.0769 | 40.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 4 | 01:04 | 1 | 0.0072 | 1 | 0.0077 | 0.0 | – | – | – | – | – | – |
| 5 | 01:05 | 5 | 0.0362 | 4 | 0.0308 | 0.0 | – | – | – | – | – | – |
| 6 | 02:01 | 16 | 0.1159 | 16 | 0.1231 | 56.2 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 7 | 03:01 | 6 | 0.0435 | 5 | 0.0385 | 0.0 | – | – | – | – | – | – |
| 8 | 03:02 | 1 | 0.0072 | – | – | – | – | – | – | – | – | – |
| 9 | 03:03 | 8 | 0.0580 | 9 | 0.0692 | 0.0 | – | – | – | – | – | – |
| 10 | 04:01 | 15 | 0.1087 | 15 | 0.1154 | 33.3 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 11 | 05:01 | 14 | 0.1014 | 19 | 0.1462 | 26.3 | 97.2 | 100.0 | 96.8 | 83.3 | 100.0 | – |
| 12 | 05:05 | 9 | 0.0652 | 9 | 0.0692 | 11.1 | 97.2 | 0.0 | 100.0 | – | 99.2 | 05:01 (100) |
| 13 | 06:01 | 2 | 0.0145 | 2 | 0.0154 | 0.0 | – | – | – | – | – | – |
| <i>HLA-DQB1 Overall accuracy: 97.7%, Call rate: 34.9%</i> | | | | | | | | | | | | |
| 1 | 02:01 | 17 | 0.1149 | 16 | 0.1270 | 18.8 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 2 | 02:02 | 12 | 0.0811 | 14 | 0.1111 | 0.0 | – | – | – | – | – | – |
| 3 | 02:03 | 1 | 0.0068 | – | – | – | – | – | – | – | – | – |
| 4 | 03:01 | 20 | 0.1351 | 16 | 0.1270 | 25.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 5 | 03:02 | 7 | 0.0473 | 6 | 0.0476 | 66.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 6 | 03:03 | 2 | 0.0135 | 1 | 0.0079 | 0.0 | – | – | – | – | – | – |
| 7 | 03:09 | 1 | 0.0068 | – | – | – | – | – | – | – | – | – |
| 8 | 03:19 | 9 | 0.0608 | 7 | 0.0556 | 0.0 | – | – | – | – | – | – |
| 9 | 04:02 | 11 | 0.0743 | 10 | 0.0794 | 70.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 10 | 05:01 | 18 | 0.1216 | 19 | 0.1508 | 47.4 | 97.7 | 100.0 | 97.1 | 90.0 | 100.0 | – |
| 11 | 05:02 | 6 | 0.0405 | 5 | 0.0397 | 60.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 12 | 05:03 | 2 | 0.0135 | 2 | 0.0159 | 0.0 | – | – | – | – | – | – |
| 13 | 06:02 | 26 | 0.1757 | 18 | 0.1429 | 66.7 | 97.7 | 91.7 | 100.0 | 100.0 | 99.1 | 05:01 (100) |
| 14 | 06:03 | 7 | 0.0473 | 6 | 0.0476 | 16.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 15 | 06:04 | 3 | 0.0203 | 2 | 0.0159 | 0.0 | – | – | – | – | – | – |
| 16 | 06:05 | 2 | 0.0135 | 2 | 0.0159 | 0.0 | – | – | – | – | – | – |
| 17 | 06:09 | 4 | 0.0270 | 2 | 0.0159 | 50.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| <i>HLA-DPB1: Overall accuracy: 75.0%, Call rate: 12.9%</i> | | | | | | | | | | | | |
| 1 | 01:01 | 17 | 0.1932 | 16 | 0.2581 | 31.2 | 75.0 | 100.0 | 33.3 | 71.4 | 100.0 | – |
| 2 | 02:01 | 15 | 0.1705 | 9 | 0.1452 | 0.0 | – | – | – | – | – | – |
| 3 | 03:01 | 2 | 0.0227 | 1 | 0.0161 | 0.0 | – | – | – | – | – | – |
| 4 | 04:01 | 8 | 0.0909 | 6 | 0.0968 | 16.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | – |
| 5 | 04:02 | 1 | 0.0114 | 1 | 0.0161 | 0.0 | – | – | – | – | – | – |
| 6 | 05:01 | 1 | 0.0114 | 1 | 0.0161 | 0.0 | – | – | – | – | – | – |
| 7 | 06:02 | 14 | 0.1591 | 12 | 0.1935 | 0.0 | – | – | – | – | – | – |

Continued on next page ...

Table 2 – continued from previous page

| | Allele | Num. Train | Freq. Train | Num. Valid. | Freq. Valid. | CR ¹ (%) | ACC ¹ (%) | SEN (%) | SPE (%) | PPV (%) | NPV (%) | Miscall ² (%) |
|----|--------|---------------|----------------|----------------|-----------------|------------------------|-------------------------|------------|------------|------------|------------|-----------------------------|
| 8 | 09:01 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 9 | 09:02 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 10 | 10:01 | 1 | 0.0114 | 1 | 0.0161 | 0.0 | – | – | – | – | – | – |
| 11 | 11:01 | 3 | 0.0341 | 3 | 0.0484 | 0.0 | – | – | – | – | – | – |
| 12 | 13:01 | 2 | 0.0227 | 1 | 0.0161 | 0.0 | – | – | – | – | – | – |
| 13 | 15:01 | 1 | 0.0114 | 1 | 0.0161 | 0.0 | – | – | – | – | – | – |
| 14 | 17:01 | 7 | 0.0795 | 3 | 0.0484 | 66.7 | 75.0 | 0.0 | 100.0 | – | 96.8 | 01:01 (100) |
| 15 | 18:01 | 3 | 0.0341 | 3 | 0.0484 | 0.0 | – | – | – | – | – | – |
| 16 | 20:01 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 17 | 34:01 | 2 | 0.0227 | 1 | 0.0161 | 0.0 | – | – | – | – | – | – |
| 18 | 49:01 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 19 | 55:01 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 20 | 71:01 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 21 | 80:01 | 1 | 0.0114 | – | – | – | – | – | – | – | – | – |
| 22 | 85:01 | 1 | 0.0114 | 1 | 0.0161 | 0.0 | – | – | – | – | – | – |
| 23 | 104:01 | 3 | 0.0341 | 2 | 0.0323 | 0.0 | – | – | – | – | – | – |

¹: CR – call rate; ACC – allele accuracy.

²: the most likely miscalled allele and the proportion of the most likely miscalled allele in all miscalled alleles.